Tecnews

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PUBLISHED MONTHLY BY THE

ELVIN W6TT **ELECTRIC SUPPLY CO.** MARIO W6DUB

149 12th STREET, OAKLAND 7, CALIFORNIA

NOVEMBER 1950

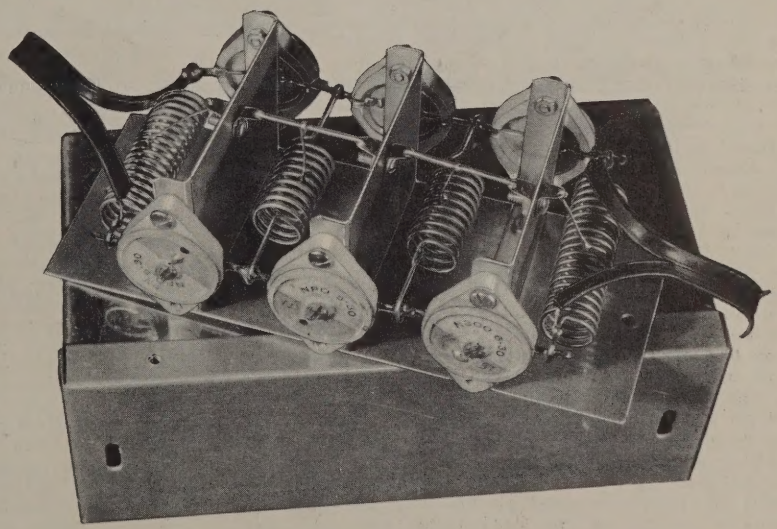
High-pass Filters for TV Receivers

By Clayton F.Bane, W6WB

Interference to television reception by amateur transmitters can be broken down into two basic catagories,--harmonic radiation and shock excitation. The reduction of harmonic radiation must of course be achieved by proper design of the transmitter itself. Shock excitation however can and does occur at frequencies far removed from the TV channel frequency and, since it is essentially due to a lack of selectivity in the TV receiver itself, there are no corrective measures that can be applied at the transmitter. It is significant to note that shock excitation may cause the most annoying type of TVI-"Tearing", "Blanking", "Flashing","Channel switching". There have been many cases of cross-hatching on the TV picture due not to harmonic radiation but to spurious beats resulting from TV receiver front-end saturation from a strong signal in close proximity. Knowing this, it would appear that a suitable filter in the TV receiver input circuit would be a logical "First" in the various possible steps to be taken in eliminating TVI.

A "High-pass" filter acts to pass all frequencies higher than its cut-off frequency and to offer attenuation to all frequencies lower than its cut-off point. Note in this reference we have used "attenuate"--not "eliminate". The amount that the undesired, lower-frequency signal will be attenuated is dependent upon how far removed its frequency is from the cut-off frequency of the filter. Thus with a cut-off point just lower than the lowest TV channel, a particular H-P filter will provide twice as much attenuation to a 14 mc signal as it will to a signal on 28 mc. Additional sections, (having the same cut-off frequency) can be added to a filter to increase its attenuation--the overall then being approximately equal to that of a single section times the number of sections used. The required number of sections in a filter used to reduce fundamental frequency in the TV receiver will depend upon the relation of the frequency of the interfering transmitter to the cut-off frequency of the H-P filter and---the amount of signal present in the front end of the TV receiver. This latter will depend upon both the transmitter output and the proximity of the transmitting and TV antennas. To summarize, interference from fundamental frequency to a TV receiver located a block away might well be eliminated by a two-

THREE-SECTION HIGH-PASS FILTER



Assembly removed from outer housing case to illustrate constructional details. Fixed capacitors may be used in place of the variables shown in model.

section filter whereas the same type of interference to your own TV receiver, (or that of your next door neighbor) may require a three-section filter. Now some comment on the effect of a H-P filter on the operation of the TV set.

The losses due to the L/C components used in the filter should be entirely negligible provided good quality capacitors are used in the series arms. The cut-off point of the filter and its impedance characteristics are far more important as regards its effect on the TV receiver. There are many TV installations in fringe areas, (or areas where reception on certain channels is poor) where introduction of a poorly designed H-P filter will degrade the picture to a point where the set owner will not permit the filter to be used, hence it is important that full consideration be given to the basic filter design.

H-P filters are designed to work into a specific impedance which will be the same as the impedance of the transmission line used on the TV antenna, (and the TV receiver input)---nominally 300 ohms. A properly terminated H-P filter with low-loss L/C elements will present very slight attenuation to signals within its pass-band. If this same filter is terminated in an impedance three or four times higher than its own design value, the shape of its attenuation curve changes radically, rising rather rapidly at the cut-off point and putting a "trough" in the pass-band which may represent several db drop in signal input to certain TV channels. If the filter is terminated in a much lower impedance, its cutoff point may not be sharply defined and there may as a consequence, be attenuation to channels very close to this cut-off frequency. From this, it is important, (in low TV signal areas) that attenuation in the pass-band of the filter be reduced to the lowest possible value by designing the filter for the correct line impedance. Further, that the impedance be maintained by using components in close agreement with the theoretical calculated values. It is apparent that the problem of impedance irregularities and variation in cut-off frequency are magnified when multiple filter sections are used. It is of practical importance that the cut-off point of the filter is not established too close to the start of the lowest TV channel. This last statement may appear a bit paradoxical in that maximum attenuation is obtained from a given filter when the cut-off point is as far removed as possible from the operating frequency of the transmitter. This of course would mean a cut-off very near to the lowest TV channel. However, better to add an additional filter section to make up for any drop in attenuation than to risk a cut-off falling within the TV bands. All this isn't as far fetched as it may sound. If capacitors with 20% tolerance are used in the H-P filter, the cut-off points of the individual sections may not only differ to produce "bobbles" within the TV bands but cut-off may actually occur within these bands. So then to constructional details of a practical high-pass filter.

The impedance into which the filters must operate is well standardized at 300 ohms,---TV channels are the same everywhere,---there would appear to be no reason why the filter shown here cannot simply be duplicated without need for any further calculations. This filter is a completely balanced-to-ground, three section, high-pass with a cut-off frequency near 40 megacycles. Installation of this filter between the 300 ohm line and the antenna terminals of the NATIONAL TV receiver at W6WB completely cleaned up white flashes,(due to keying) and eliminated a tendency to "tear" and distort the picture on Channel 4. A careful check was made with and without the filter and no loss of signal could be detected on any of the three channels now operating in this area.(4,5 and 7) Transmitter input 1kw---transmitting beam directly over the TV antenna. (about 25' higher)

The most critical thing about this filter, (or any other similiar H-P) is the value of the capacitors in the series arms. Normal 20% micas just wont do. The exact capacity shown, 14 mmf, while highly desirable is not as important as having all capacitors nearly equal in value. In no case should the tolerance be less than 5%---2% would be excellent. Also, best to be on the high side, i.e., 15 mmf instead of 12 mmf. The only reason for using the variable ceramic trimmers that will be noted in the photograph was that they happened to be available as was a capacity bridge to set them to exact value.

The inductors are wound with #14 bare wire, (enameled will do equally well) on a ½" form; the resulting spring-like coil then being spaced out by threading the coil turns through the shank of a small screwdriver. Final lengths were achieved by stretching out or pushing turns together. It is important that the number of turns be followed exactly---also that the center-taps be set at equal numbers of turns from either end. The actual mounting is subject to wide variation although it will be advisable to provide baffle plates between individual coils similiar to those used on the filter shown herein. The entire assembly must be totally enclosed in a shielded box although one of the small aluminum chassis can be used if a suitable bottom plate is provided. Installation of the unit should be such that there is a minimum of connecting line to the TV receiver antenna terminals. Be sure to ground the filter case to the TV chassis!!!

Failure of a good H-P filter to clear up fundamental-frequency interference can be due to direct pickup by RF circuits of the TV receiver and/or to RF getting into these circuits through the 110 volt line. In such cases, line filters and shielding may be indicated but you can't know this until you have eliminated the most probable source of fundamental TVI--pick-up by the TV antenna and transmission line.

NEW, 16" RECTANGULAR "BLACK-FACE" TUBE
The whole face of the tube is used..no corners are lost! "Black-face" tube provides greater contrast under normal lighting conditions.

EXTRA SENSITIVITY...
Latest turret-type tuner and an extra stage of I.F. amplification insure excellent reception.

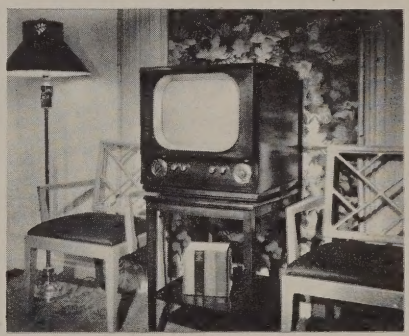
NEW "PICTURE-LOCK" CIRCUITS
No flicker, "tearing" or jumping. Movie steady!

AUTOMATIC FREQUENCY CONTROL
Eliminates drift..keeps set locked in perfect sync with transmitter. Minimizes interference.

CAREFULLY SHIELDED CHASSIS
A distinct help in reducing TVI.

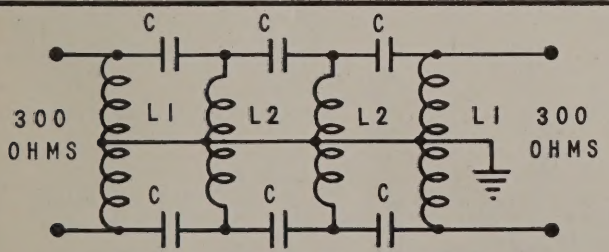
DOUBLE-TUNED R.F. BANDPASS
Greatly increases selectivity..good rejection to H.F. signals outside the TV channels.

BOTH CONSOLE AND TABLE MODELS
This excellent receiver is available in both console and table models both of which are illustrated in the two photographs.

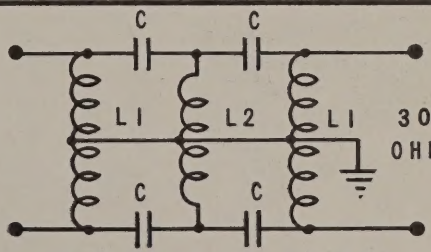


NATIONAL TELEVISION

Custom-built by the makers of precision electronic equipment for the government, for airlines, for science, for radio amateurs the world over.



THREE-SECTION FILTER



TWO-SECTION FILTER

L1 = No. 14 wire, wound on $\frac{1}{2}$" diam. form. 18 turns, C-T. Spaced to $2\frac{1}{4}$" long. Leads, $\frac{1}{2}$".
L2 = No. 14 wire, wound on $\frac{1}{2}$" diam. form. 10 turns, C-T. Spaced to $1\frac{1}{4}$" long. Leads, $\frac{1}{2}$".
C = 14 micro-microfarads. Ceramic or mica. Tolerance, 5% or less.

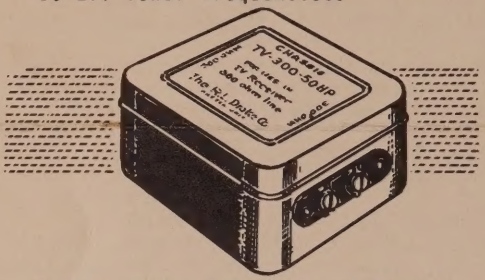
STOP TELEVISION INTERFERENCE

AT THE RECEIVER....

DRAKE

HI-PASS FILTERS

A simple but highly effective 2 section m-derived circuit designed to cut-off at 50 mc and provide high attenuation to all lower frequencies.



When an amateur transmitter is located close to a TV receiver, the most common trouble is simple overloading of the TV receiver's front-end by the fundamental output of the transmitter. In other cases, strong fundamental signals or harmonics, in or near the I.F. band-pass of the TV receiver may cause trouble. The Drake hi-pass filter will eliminate or greatly reduce these two types of interference to TV reception.

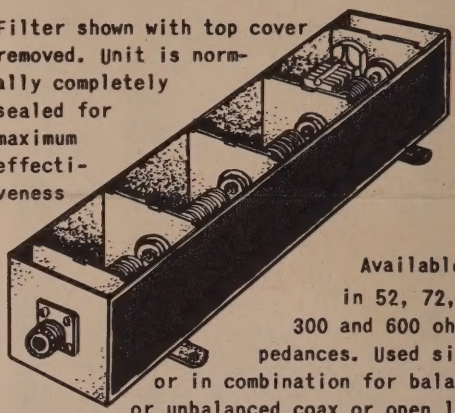
AMATEUR NET PRICE...$3.57

AT THE TRANSMITTER....

B & W

LO-PASS FILTERS

Filter shown with top cover removed. Unit is normally completely sealed for maximum effectiveness



Available in 52, 72, 300 and 600 ohm impedances. Used singly or in combination for balanced or unbalanced coax or open lines.

- **Provide extreme attenuation to all harmonics above 30 mc**
- **Eliminate individual filters for each band**
- **Handle 1 kilowatt with ease**
- **Insertion loss less than .25 db**

AMATEUR NET PRICE...$22.50

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